

Stormwater Management

for

New Hampshire Communities

Prepared for the
New Hampshire Department of Environmental Services
by the
Southern New Hampshire Planning Commission

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At the time of this writing, the U.S. Environmental Protection Agency's Phase II, National Pollutant Discharge Elimination System rules were scheduled to take effect in the fall of 1999. A significant focus of this handbook is the content of these rules and their implementation by New Hampshire communities.

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FOREWORD

Nearly every stormwater management publication contains the statement “The key to reducing water quality problems due to sediment and pollutants is to focus on stopping erosion and controlling pollutants in the first place.” It is easier to prevent problems in the beginning than to restore a clean environment after a forgetful disregard for natural processes. This is a handbook for local officials addressing the stormwater related concerns of municipal administrative bodies, road agents, planning boards and departments of public works and highways. It is written to organize and illuminate the field of stormwater management from the perspective of the community and its responsibility to encourage sound water control practices.

In their effort to address stormwater issues, communities have many public and private resources offering a great deal of runoff management information and many forms of assistance. Using this handbook, community officials can structure an orderly approach for dealing with local stormwater management. Existing federal and state rules and regulations are reviewed along with many suggestions for stormwater control initiatives that could be implemented as community programs. Technical manuals and public agencies providing stormwater management assistance are listed to provide expanded information and direction once a community has decided to address runoff issues.

This publication is intended to spark a community-based comprehensive strategy for managing the increasing stormwater runoff problem and to provide the necessary guidance for effective local programs that will benefit all New Hampshire residents.

CHAPTER I

Stormwater Runoff and the Concern of Communities

Stormwater and its Consequences

Stormwater runoff is water from rainstorms or snowmelts that flows over the land rather than evaporating or soaking into the ground. In the undeveloped landscape, vegetation slows the runoff of stormwater and allows more time for percolation into the groundwater reservoir. With a vegetated landscape, the stormwater is contained on the soil surface and on leaves and branches, providing time for percolation into the ground water as well as evaporation. In these natural landscapes, floods are less flashy, less frequent, less severe (floodwater does not reach as deep a crest height because it accumulates slowly rather than all at once) and cause less soil and bank erosion.

However, in developed areas where the natural landscape cover has been replaced with non-porous surfaces (for homes, businesses, streets and parking), the character of runoff changes dramatically. These impervious surfaces cause water to remain on the land surface and, without slow percolation into the soil, water accumulates and runs off in larger quantities. This faster moving water washes soil from all earth surfaces that are not securely held in place by structural means or healthy vegetation. The results are found in eroded stream banks, damaged vegetation and widened channels.

Typically, inlets and piping are used to prevent flooding in urban areas by moving the water to lower waterways and away from streets and buildings. These piped drainage systems remove water quickly and transport it to streams and main flow channels. This rapid flush of stormwater can cause flooding and washouts in areas below the upstream drainage network. Land development with poor groundwater management can alter a watershed stream flow in the following ways:

- Peak discharge. The rate of stormwater flow in the drainage system increases. The frequency and severity of flooding is greater.
- Volume. The quantity of water flowing as runoff increases due to less infiltration.
- Timing. With storm drainage pipes and ditches in place, the time required for runoff to reach a stream can be reduced to half the original period. Furthermore, high flows are compressed into a shorter period. After development, streams are often described as “flashy” because water levels rise and fall very quickly in response to storms.
- Velocity. Runoff water speed increases during storms due to higher peak discharges and smoother flow channels.
- Base flow. Stream flow is reduced between storms; small streams may “dry up” in the summer because the forested natural reservoir no longer exists.

Stormwater runoff from urban areas directly impacts the quality of water found in groundwater, streams and water bodies. The problems most often caused by unchecked stormwater include:

- Increased flooding
- Reduced water quality
- Loss of habitat and recreational use

Flooding

The frequency and severity of flooding increases as development occurs in the watershed. Large quantities of rapidly flowing runoff water create new flooding patterns, cause additional channel erosion and contribute to habitat destruction. In natural conditions, a stream develops a channel large enough to hold the peak flow that typically occurs every 1 to 2 years. In developed areas, where roofs and pavements have been constructed, the typical flow is surprisingly greater. Erosion of a larger stream or river channel is often rapid because floodplain soils are loose and wash easily. This wash material continues to settle in slow water and is carried as sediment in fast-moving water. Downstream water habitats are quickly covered with silt and aquatic bottom life is changed for many years.

The floodplain, as well as the channel of a stream, becomes wider as development occurs in the watershed. Because of the greater impervious land cover in development areas, the peak flow of storm or snowmelt runoff water and the total amount of water discharge increase. Land and buildings that were once safe even from the 100-year storm can become at risk due to the altered drainage following upstream development.

Water Quality

Water quality can be quickly compromised by poorly managed stormwater. Runoff that flows from city streets, parking lots, driveways and lawns often carries a heavy load of pollutants to nearby lakes and streams. Some pollutants are commonly found in urban areas such as oils, manufacturing chemicals and street and road treatment materials. Water analysis reveals, however, that both urban and rural runoff can carry sediment, nutrients, oxygen-demanding materials, bacteria and toxins that pollute the water resource and cause a rise in temperature.

Sediment. Land uses that produce large sediment loads in developed areas are industrial sites, commercial development and freeways. In residential and commercial areas, street surfaces are the primary source of sediment. The highest loads of sediment come from areas under construction. Construction sites have high erosion rates because they are frequently stripped of vegetation and topsoil during the construction process. If erosion controls are not in place, stormwater runoff can carry more than half the eroded soil from a construction site to nearby lakes, streams or wetlands.

Nutrients. Runoff frequently contains nutrients such as phosphorus and nitrogen from fertilizers and the decay of organic material. Phosphorus is of greatest concern in stormwater runoff because it usually promotes weed and algae growth in freshwater lakes and streams. Construction sites

represent significant sources of phosphorus. The phosphorus molecule is found attached to runoff sediment particles, dissolved lawn fertilizer and the residues from automobile exhaust.

Nitrogen is added to the environment primarily through fertilizer applications, septic leaching fields or raw sewage outlets. Nitrogen in soils and water encourages bacteria to multiply and digest the nitrogen. In this process, the bacteria reduce the available oxygen in confined water bodies such as estuaries, lakes and ponds, resulting in fish kills.

Oxygen-demanding Material. Animal waste, leaves, grass clippings and plant litter in waterways decay with the resulting use of available oxygen. This depletion of oxygen for aquatic species occurs suddenly following a surge of runoff from storms. Slow-moving water with organic pollutants is most vulnerable for low oxygen events. Runoff with the highest oxygen demand comes from older residential areas with more pavement, pets and combined sewers.

Bacteria. Sources of bacteria in runoff water include sanitary sewer overflows, illicit sewer connections, domestic and wild animals. Fecal coliform bacteria counts in urban runoff are commonly elevated above safe recreational water standards.

Trace Metals. The trace metals (lead, zinc, copper) are toxic pollutants that have been extensively monitored by the National Urban Runoff Program since the early 1980's. A primary source of trace metals in urban runoff is vehicle traffic. Other sources include roof materials, outdoor storage piles of salt and other manufacturing materials, scrap metal piles and coal piles (mercury, arsenic). Also, many other sources exist including paints manufactured before 1977, air-borne emissions from coal burning, wood preservatives and oil or municipal sewage that may carry trace metals.

Human and animal health threats caused by trace metals:

- Lead: damage to the nervous system and kidneys; high blood pressure and digestive disorders; toxic to aquatic life.
- Zinc: toxic to aquatic life.
- Copper: toxic to humans and aquatic life; anemia, liver and kidney damage.
- Cadmium: concentrations are frequently high enough to kill aquatic life; long-term health problems may include cancer and kidney damage.
- Chromium: chromium can cause damage to the liver and kidneys; it can also affect the immune system and reproduction.

Pesticides. Pesticides are often present in urban and agricultural runoff. Lawn, garden and agricultural pesticides and herbicides are commonly found in the runoff from both developed and rural areas.

Other Toxic Chemicals. Monitoring suggests that polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) are the two groups of chemicals that can be present in high urban runoff concentrations. PAHs are common by-products of incomplete combustion from vehicles, wood and oil burning furnaces and incinerators; they are carcinogens. PCBs are used in

vehicles, wood and oil burning furnaces and incinerators; they are carcinogens. PCBs are used in transformers, electrical capacitors for fluorescent lights, coolants and lubricants. They remain in the environment for long periods of time and can cause liver and cancer problems, reproduction problems and immunity to disease.

Temperature. Runoff water temperature has been found to be higher in developed areas. This is caused by warm roofs and pavements, shallow ponds having warm water that overflows during storm events and water flowing in landscapes having less shade from tree-lined streams and woodlands. Warm water has less dissolved oxygen for aquatic species and increases the toxicity of trace metals. Warmer water may not be compatible with the original ecology of downstream areas, causing a change in habitat and natural balance.

The figure below illustrates an approach for improving water quality that has been denigrated by commercial, industrial and residential development.



Habitat and Recreational Impacts

When water quality is degraded by unmanaged stormwater runoff, aquatic life is detrimentally changed. Recreational and food source fish populations are reduced: diversity decreases, abundance is reduced and tolerant species increase. In addition, insects as a food source are reduced. The change in fish populations due to pollution can cause a reduction in the recreational value of water bodies. These ponds and streams can become less appealing as stormwater management and pollution prevention programs are delayed. The polluted waters are frequently considered as having little worth and can degrade further as pollutants continue to find their way to the wasted resources.

Even though developed areas cover a small percentage of land in New Hampshire, urban stormwater runoff affects the quality of the State's water resources and is a major cause of property damage resulting from flooding and erosion. It is essential for communities to address the stormwater runoff issue to prevent future water quality damages and to restore the value of water resources for the use of both humans and wildlife

The Economic Benefits of Stormwater Management

Sound stormwater management can have beneficial impacts on all life in the watershed. Health problems can be avoided and economic losses can be greatly reduced when stormwater is properly accommodated. Solutions are usually simple and uncomplicated. They often include techniques such as constructing settlement and detention ponds, retaining existing vegetation at development sites, immediate and thorough replanting of vegetation, proper surface grading and drainage design and master planning for water runoff.

Often required by communities for new development projects, man-made ponds for temporarily holding and slowly releasing runoff water can be designed to enhance the setting for residential or commercial buildings. Through careful engineering, these water bodies or meadow areas can provide appealing vistas, wildlife habitat and theme landscapes that create a character and sense of place for the new project. In an EPA report on the economic benefits of runoff controls, financial benefits represented by higher property values and increased rental income are achieved by placing water and views near living and business landscape settings.

Wet ponds and constructed wetlands are two types of stormwater detention features that can be incorporated into the outdoor living environments in new developments. Wet ponds are stormwater runoff holding facilities that have water in them year-round. These ponds are designed to collect and gradually release stormwater to nearby streams and groundwater reservoirs over a period of time. The ponds are created with extra depth so that after the runoff has been shed a shallow water depth remains for wildlife and visual appeal.

Constructed wetlands are vegetated depressions that serve as a natural filter for runoff from developed sites. Wetlands slow the flow of runoff to streams, rivers and lakes and allow the groundwater to be replenished. Constructed wetlands are an important technique in the selection of stormwater controls, since they offer pollutant removal, minimum maintenance over long time

periods and wildlife habitat potential. Recreational trails, interpretive walks and parkland development can be complementary to the new water feature and the development as well.

Some maintenance of stormwater management water bodies is generally needed to ensure safety and to preserve the environmental and monetary benefits of water-edge settings. When young children are nearby, ponds having deeper water may require a barrier such as ornamental or dark-colored chain link fencing designed to be appealing while providing safety. Mosquitoes can be controlled by introducing natural predators (fish or bacteria) and by moving or aerating the water with circulation pumps and fountains. In many successful developments constructed wetlands and wet ponds have proven to be both an environmental benefit and an aesthetically pleasing landscape enhancement.



Erosion Control Magazine, April, 1999, Pg. 10.

Stormwater Detention Pond

The following is a quote from the EPA report entitled *Economic Benefits of Runoff Controls*; (EPA-841-S-95-002):

"When designed and sited correctly, artificial lakes or wetlands can help developers reduce negative environmental impacts caused by the development process and increase the value of the property.... Urban runoff controls that are pleasing to the eye and safe for children can lead to increased property values. Because the beauty of natural surroundings can increase real property values and enhance the quality of life, beautification of land areas adjacent to waterways and detention ponds should be considered an integral part of planning by developers. For existing runoff controls that are unsightly, corrective renovations can be made to increase the property value and quality of life."

It is essential for everyone to address the issue of stormwater runoff. Good stormwater management protects the value and quality of water resources for use by humans as well as other aquatic and land species.

The remaining sections of this handbook describe practical and effective steps that a community can take to incorporate stormwater management techniques into the local land use management process. Federal and state agencies are listed as sources of the most current stormwater management information to assist officials and volunteers with the implementation of stormwater controls.

CHAPTER II

Requirements for Stormwater Management

Stormwater management is often not an option, but a requirement under federal and state law. For example, the U.S. Environmental Protection Agency's (EPA) Phase I rules apply to operators of certain industrial operations and communities with populations of over 100,000, and current Phase II draft pollutant discharge regulations would apply to smaller cities in the state.

This chapter offers a brief description of when a Phase I National Pollutant Discharge Elimination System (NPDES) permit is needed, and what steps an operator must follow to meet the requirements. While compliance with these regulations is only required of the larger municipalities in the state, everyone would benefit if stormwater management were part of all development review in each community. The minimum control measures that are required in obtaining a permit can easily be adapted by non-regulated communities that are interested in the protection of water resources through the elimination or reduction of incoming pollutant flow from stormwater.

EPA Regulations

The following facilities having stormwater discharges associated with industrial activity are subject to the present Phase I National Pollutant Discharge Elimination System (NPDES) regulations. With the exception of power plants, some sanitary facilities and airports, municipally owned facilities are not currently required to apply for an NPDES permit.

- Facilities subject to stormwater effluent standards (designated by the EPA)
- Industries with specified Standard Industrial Classification codes
- Hazardous waste treatment, storage or disposal facilities
- Landfills or land application sites that have received industrial wastes
- Recycling facilities, battery reclaimers and junkyards
- Steam electric power plants
- Transportation facilities with maintenance, fueling, equipment cleaning or airport deicing operations
- Sewage and sludge treatment plants with design flows greater than 1.0 million gallons per day (MGD) or with Pretreatment Programs
- Construction activities that disturb more than 5 acres

The Phase II EPA NPDES rule making is scheduled to become effective in the fall of 1999 (an October 27, 1999 effective date is currently anticipated). If promulgated as proposed, the Phase II regulations will require:

- Designated communities smaller than 100,000 persons (small cities) to develop, implement and enforce a stormwater management program to address discharge pollutants including sediment, floatables, oil and grease, as well as other pollutants from illicit discharges.

- The proposed Phase II rules will also require permits for construction sites that disturb equal to or greater than one but less than five acres of land. Construction site pollutants include sediments, oil, grease and floatables.

Small municipal separate storm sewer systems may also be designated for permit coverage on a case-by-case basis by EPA if stormwater discharges are causing, or contributing to, surface water quality standard violations. The proposed Phase II rule provides a waiver from the permit requirement for Phase I industrial facilities if they can certify that they do not produce pollutants or that their pollutants are not exposed to stormwater.

The EPA NPDES Phase II rule applies to the six larger New Hampshire communities and the three co-applicant communities:

Portsmouth

Rochester

Somersworth

Dover

Manchester

Nashua, and

the co-permittees with Massachusetts border towns:

Pelham

Salem

Plaistow

As previously mentioned, the following minimum control measures provide an excellent framework for establishing a stormwater management program in any New Hampshire community regardless of NPDES permit requirements.

NPDES permit requirements for operators of regulated small municipal separate storm sewer systems

The NPDES municipal stormwater permit applicants will be required to develop, implement and enforce a stormwater management program designed to reduce the discharge of pollutants from the municipal separate storm sewer system to the maximum extent practicable and protect water quality. Implementation of the best management practices (BMPs) to reduce water pollution through the local stormwater management program as permitted by EPA will constitute compliance with the standard of “reducing pollutants to the maximum extent practicable.”

BMPs are runoff water management measures that control water flow and reduce the pollutants reaching streams, rivers, ponds and lakes. BMPs are described in the handbook “Best Management Practices for Urban Stormwater Runoff,” NHDES, Water Supply and Pollution Control Division, January, 1996.

The following list of six minimum control measures are required by the draft U. S. Environmental Protection Agency rule making for the Phase II National Pollutant Discharge Elimination System:

1. Public education and outreach on stormwater impacts. Carry through a public education program to distribute educational materials to the community (all ages, minorities and disadvantaged) or conduct equivalent outreach activities explaining the impacts of stormwater discharges on water bodies and the steps that can be taken to reduce stormwater pollution.
2. Public involvement and participation. The public must be included in the development, implementation and review of the local stormwater program. Representative panels or committees, public hearings or volunteer programs are methods for involving the public in the municipal stormwater program.
3. Illicit discharge detection and elimination. Prepare a stormwater system map showing the location of major pipes, outfalls and topography and areas of concentrated activities that may contribute to stormwater pollution. Through local regulations, prohibit illicit discharges into the storm sewer system and implement appropriate enforcement procedures and actions. Implement a plan to detect and address illicit discharges including illegal dumping of pollutants. Inform public employees, businesses and the general public of hazards associated with illegal discharges and improper disposal. Storm drain stenciling, publication distribution and a citizen reporting program are examples of actions that can be undertaken.
4. Construction site stormwater runoff control. Develop, implement and enforce a program to reduce pollutants in stormwater runoff to the municipal separate storm sewer system from construction activities that result in land disturbance of greater than or equal to one acre. Using an ordinance or other regulatory mechanism that controls erosion and sediment to the maximum extent practicable, all materials at the construction site that may pollute must be addressed such as discarded building materials, concrete truck washout and sanitary waste. The regulations should also require construction site owners or operators to implement appropriate BMPs, provisions for pre-construction review of site management plans, procedures for receipt and consideration of information submitted by the public, regular inspections during construction and penalties to ensure compliance.
5. Post-construction stormwater management in new development and redevelopment. Develop, implement and enforce a program to address stormwater runoff from new development and redevelopment projects that result in land disturbance of greater than or equal to one acre and that discharge into the municipal separate storm sewer system. The program must include a plan to implement site-appropriate and cost-effective structural and non-structural best management practices and ensure adequate long-term operation and maintenance of such BMPs. EPA recommends that municipalities establish requirements for the use of cost-effective BMPs that minimize negative water quality impacts and attempt to maintain pre-development runoff conditions (e.g. wet ponds and extended detention outlet structures, filtration practices and infiltration practices). Locally based watershed planning and the use of preventive measures, including regulations, are suggested as program elements. These often include ordinances involving the limitation of growth in identified areas, protection of

sensitive areas such as wetlands, and the formation of guidelines that minimize impervious surfaces, maintain open space and minimize disturbance of soils and vegetation.

6. Pollution prevention and good housekeeping for municipal operations. Develop and implement a cost-effective operations and maintenance program with the ultimate goal of preventing or reducing pollutant runoff from municipal operations. Using available informational materials (from EPA or NHDES), the program must include local government employee training to prevent and reduce stormwater pollution from government operations such as park and open space maintenance, fleet maintenance and stormwater system maintenance. The EPA recommends that, at a minimum, the following elements be included in the municipal program: maintenance activities, maintenance schedules and long-term inspection procedures for structural and other stormwater controls to reduce floatables and other pollutants discharged from community separate storm sewers. Control structures may include retention and detention ponds, buffer strips and other BMPs that reduce or eliminate the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards and waste transfer stations. The municipality should also develop procedures for properly disposing of waste removed from the separate storm sewer systems and the source areas listed above. In addition, the procedures should include methods to ensure that new flood management projects assess the impacts on water quality. Existing flood control projects should be examined for opportunities to incorporate additional water quality protection devices or practices.

The qualifying local or state program requirements must incorporate, by reference, the items above and the following guidelines for successful EPA permit application completion:

1. The Best Management Practices to be implemented and the measurable goals for each of the stormwater minimum control measures including:
 - Illicit discharge detection and elimination;
 - Construction site stormwater runoff control;
 - Post-construction stormwater management in new development and redevelopment; and
 - Pollution prevention and good housekeeping for municipal operations.

The EPA guidelines indicate that the BMPs identified in the community Notice Of Intent will not constitute a condition of the permit unless the EPA or the State of New Hampshire has provided or issued a menu of regionally appropriate and field-tested BMPs that the State or EPA has endorsed as most cost-effective.

2. The month and year in which the operator/community will start and aim to complete each of the measures, or indicate the frequency of the action.
3. The person or persons responsible for implementing or coordinating the stormwater management program.

4. Compliance with other NPDES permit requirements, standards and conditions established in the individual or general permit developed consistent with federal regulations.
5. An evaluation and assessment process must be instituted to include:
 - a. Program accomplishment evaluation;
 - b. Record keeping, 3 years;
 - c. Annual reporting, including:
 - i. status of compliance;
 - ii. results of information collected and analyzed;
 - iii. summary of the stormwater activities you plan to undertake; and
 - iv. change in any identified measurable goals that apply to program elements.

Communities can obtain assistance with their compliance responsibilities by contacting the U.S. Environmental Protection Agency Boston office (Thelma Murphy at 617-918-1615) or the New Hampshire Department of Environmental Services, Water Division (603-271-2358).

Suggested actions for all New Hampshire communities:

1. Local subdivision and site plan review regulations should reference state permit requirements for wetland dredging and filling, shoreland protection and terrain alteration. For coastal communities, comprehensive stormwater and water quality management guidelines are available from the Office of State Planning Coastal Program Office at 152 Court Street, Portsmouth, NH 03801; 603-433-7187.
2. The New Hampshire “Model Stormwater Management and Erosion Control Regulation” should be included in local Subdivision and Site Plan Review regulations; see Appendix C. This will help to assure that all private development is properly designed and constructed to reduce or eliminate stormwater damage and pollution.
3. Prepare a plan for addressing the stormwater issue in the community. Determine those activities and projects that should be implemented for effective stormwater management. As a guide for effective stormwater management actions, New Hampshire communities are urged to use the six minimum measures set forth in the Phase II NPDES regulations (outlined at the beginning of this chapter). A suggested outline for a stormwater management plan “Table of Contents” is found in Chapter III.
4. As a product of stormwater planning in the community, establish priorities for stormwater management actions and make schedules/assignments for implementation of local projects and programs. Make two lists and plan implementation tasks to accommodate short-term and long-term preparation requirements:
 - 1) priority projects that can be undertaken immediately with existing resources; and
 - 2) priority projects that will require planning and funding before implementation.

Publicize the progress and successes of the early projects to build support for activities that will require greater public funding and cooperation. Conduct a community-wide education and information program explaining the stormwater problem with an emphasis on the priority projects for local stormwater management. Chapter III and Appendix E contain helpful tips for planning a successful education program.

5. Initiate a program of house cleaning and maintenance for municipal stormwater facilities. If the municipality conducts stormwater maintenance activities in public areas and the private landscape receives management attention through site plan and subdivision regulations, a significant advance toward community-wide clean stormwater runoff can be reality. Chapter III contains pointers for municipal house cleaning and maintenance.

CHAPTER III

Community Stormwater Projects and Programs

There are several levels at which a community can be involved with stormwater management. Whether you are being required by federal and state regulations or just have an interest in protecting the water quality of your lakes and streams, the following programs and projects will assist you in meeting your goals.

Develop a Community Stormwater Plan

Through the preparation of a comprehensive stormwater plan, a community focuses on the big picture first and then sets priority tasks for upgrading all elements of the local storm runoff and water quality system. The plan can be prepared by a consultant or by local residents with technical assistance from state or federal water and soil agencies or the regional planning commission (when expertise is available). One option is to establish a Stormwater Planning Committee made up of representatives from the planning board, local road officials, the public works department, the community administrative body or their representative, the conservation commission, the emergency management director, and interested members of the general public. Members can be assigned topics to research for meeting discussion and report development. A volunteer report writer or a consultant could receive the committee findings and decisions and assemble the information into a comprehensive community plan.

Planning for community stormwater management is accomplished through a process that:

- encourages public participation as a partner in the development of a stormwater plan and local program;
- assesses the current stormwater successes and problems;
- sets goals and objectives for needed accomplishments; and
- establishes task priorities for stormwater management recommendations.

The four components needed for a stormwater plan are:

- a land use plan;
- performance criteria for the use of best management practices;
- financing opportunities through bonding, impact fees and taxes; and
- stormwater and erosion control provisions as a part of local subdivision and site plan review regulations.

If the community is designated by the EPA as a municipality that must meet the Phase II NPDES requirements, the stormwater plan should present a strategy for fulfilling the six minimum control measures that are stipulated in the draft EPA amendments described earlier in Chapter II.

Completing an outline or table of contents for a Community Stormwater Management Plan is the first step of the planning process. This outline guides both water quantity and water quality aspects of stormwater planning.

Suggested Table of Contents: A Community Stormwater Management Plan

I. Introduction

- A. Purpose, scope, the planning products to be developed and the components of the plan.

II. Description of the local watersheds

- A. Delineation of current and future (expected) land uses
- B. Identification of existing stormwater management practices
- C. Existing stormwater drainage system showing water resources

III. Statement of Problems or Issues

- A. The beneficial character of water bodies and resources
- B. Problems and threats that compromise the benefits of local water resources
 - 1. Water quality problems
 - 2. Flow related problems including erosion and road damages

IV. Sources of the Problems (consider quantity of water and quality of water problems)

- A. Sources of stormwater runoff
 - 1. Existing land uses, planned land uses
 - 2. Mapping of the critical runoff quantity areas
- B. Sources of pollutants in stormwater runoff from existing and planned urban areas
 - 1. Construction site erosion
 - 2. Road drainage sources
 - 3. Dry weather pollutant sources
 - 4. Wet weather pollutant sources
 - 5. Total loadings and concentrations for all sources
- C. Analysis: sites where pollutant reductions and improvements are needed and the magnitude of the problem; mapping of critical runoff quality areas

- II. Evaluation of alternative best management practices (BMPs) to reduce pollutant loadings and water runoff from the most problematical source areas; determine the effectiveness of the alternatives.
 - A. Alternative control practices for quantity runoff
 - B. Alternative control practices for quality runoff
- III. Costs of control practices identified in the alternative combinations
- IV. Ranking of alternative BMP controls
 - A. For quantity runoff control practices
 - B. For construction site erosion control practices needed
 - C. For road construction and maintenance practices
 - D. For streambank erosion control practices needed
 - E. For quality runoff control practices
 - F. For dry weather flow pollution control practices
- V. Construction feasibility
 - A. Can the improvement be effectively located or initiated?
 - B. Will the improvement meet state and federal regulations?
 - C. Is public opinion in favor of the selected controls?
- VI. Summarizing the findings into a Community Stormwater Management Plan
 - A. Water quantity management priority recommendations
 - 1. Runoff recommendations
 - 2. Flood control recommendations
 - B. Water quality management priority recommendations
 - C. Public education initiatives
 - D. Financing methods:
 - 1. Bonding proposed construction
 - 2. Impact fees for subdivisions and/or buildings
 - 3. Taxes for roads and public works
 - 4. Hazard mitigation disaster funding following a declared disaster
 - 5. State revolving fund loan

Conduct a Public Education Program

A stormwater management and pollutant discharge education program is a key element in the draft NPDES regulations proposed by the U. S. Environmental Protection Agency. The community program should be designed to reduce the discharge of pollutants from the municipal separate storm sewer system to the maximum extent practicable.

Handout materials for the local education program can be obtained from the NHDES, the Environmental Protection Agency, environmental organizations or other public interest or trade associations (civil engineers or landscape architects). The outreach program could inform residents of the steps that can be taken to reduce stormwater pollution, such as ensuring proper septic system maintenance, limiting the use and runoff of garden chemicals to appropriate amounts, properly disposing of used motor oil or household hazardous wastes, and becoming involved in local stream restoration activities. All residents could be encouraged to participate in stormwater management activities coordinated by youth service organizations, the conservation commission or other service groups. Some informational materials could encourage residents to participate in the municipal program by performing such services as roadside litter pickup and storm drain stenciling, or highlight the potential public health risks to children if exposed to pollution when playing near storm drains. Educational materials could also include steps that commercial, industrial and institutional entities can take to better address stormwater pollutants such as proper grease and oil disposal.

Topics to address in a local public education program:

- The character of stormwater; the background of stormwater damages in the locality
- Runoff; the impact of development on stormwater runoff
- Pollutants in runoff water from agricultural, commercial and residential areas
- Stormwater management BMPs that can control runoff rates and pollutants
- Steps that individuals can take to solve stormwater problems
- Steps the community is undertaking to implement a local stormwater management program

Stormwater management training and education for the planning board and other local officials should be included in the local education program. Land managers (residential, commercial, and industrial) could also be invited to training events. Consider mailings as a means of letting people know of stormwater issues and the actions that can be taken by private individuals and organizations to reduce pollution and erosion problems.

Incorporate stormwater management and erosion control regulations in the community subdivision and site plan review regulations (stormwater runoff management)

New Hampshire communities are encouraged to adopt the “Model Stormwater Management and Erosion Control Regulation” as an amendment to local subdivision and site plan review regulations. The New Hampshire Association of Conservation Districts developed the New Hampshire model in coordination with the New Hampshire Department of Environmental Services.

Maintenance responsibilities for the property drainage system and Best Management Practices should be contained in local subdivision and site plan review stormwater management provisions. The Model Stormwater Regulation contains suggested provisions and an enforcement process to assure that the newly constructed site drainage system continues to function into future years.

See Appendix C for the Model Stormwater Regulation.

Develop land use regulations that recognize flooding and runoff potential and provide guidelines for proper management of land use changes (floodplain management)

The Federal Emergency Management Agency and the New Hampshire Office of Emergency Management, working through the State's regional planning commissions, encourage the local planning board to prepare and gain adoption of regulations managing community floodplain development. (This is a requirement of the National Flood Insurance Program. By adopting floodplain development regulations, communities are assured that flood insurance and bank loans for flood-prone property are available to property owners). Local regulations should be annually reviewed to assure that flooding is respected and that drainage is properly addressed by proposals for new development. Effective administration of local land use regulations should be taking place; training of new board members is an important annual activity.

The New Hampshire Office of State Planning and the New Hampshire Office of Emergency Management offer guidelines and assistance for communities wishing to adopt or upgrade their floodplain regulations.

NH Office of State Planning
2½ Beacon Street
Concord, NH 03301
603-271-2155

NH Office of Emergency Management
State Office Park South
107 Pleasant Street
Concord, NH 03301
603-271-2231

Require proper design of road runoff water infrastructure

Local road officials depend on the University of New Hampshire Technology Transfer Center for road and drainage construction guidelines and training assistance. It is the responsibility of local road officials to assure that drainage infrastructure associated with public roads and land is in good condition and is properly designed and constructed to avoid road erosion and washout damage. When new facilities are to be installed, it is important to consider the future storms that could occur and the proper accommodation of "disaster level events" so that future losses will be reduced. This step in the construction process, called hazard mitigation planning, can lead to properly sized culverts, stone lined drainage ditches and better road surface drainage.

If guidance publications are not already in the Road Agent's or the Department of Public Works' files, community road maintenance and construction officials are encouraged to obtain the several current technical handbooks addressing road drainage issues.

- “Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire” - available from the New Hampshire Department of Environmental Services.
- “Best Management Practices for Urban Stormwater Runoff” - available from the New Hampshire Department of Environmental Services.
- “Drainage, Drainage, Drainage” - published by the UNH Technology Transfer Center.
- “A Series of Quick Guides for New Hampshire Towns” - published by the UNH Technology Transfer Center.

Local road official and employees should attend road construction and drainage training sessions on a regular basis. The above resources are an excellent complement for the educational curriculum.

Develop and implement a community facility “house cleaning” and maintenance program for stormwater management

1. Obtain a base map of the community so that drainage problems can be marked and discussed as the maintenance program is developed. Base maps for your community can be obtained from the regional planning commission; or you may use USGS topography sheets, 7½ minute series, that can be enlarged and would show community roads, streams and rivers, water bodies, built-up areas and topography.
2. Begin addressing stormwater management for municipal facilities by first obtaining guidance information on road construction and maintenance from the University of New Hampshire Technology Transfer Center. The publication “Drainage, Drainage, Drainage,” available from the Technology Transfer Center, is an excellent guide for community road construction and maintenance. The reference is written for local “road managers,” and contains practical guidelines that can assure high quality and well-maintained roads as well as informed employees who can make correct decisions on the job. Chapter 6 of the “Drainage” handbook entitled “Maintenance for Good Drainage” should be used as a guide when establishing a community road maintenance program.
3. Initiate a community road maintenance program. Conduct an inventory of the community drainage facilities and assess the condition of the drainage system. . Identify drainage structural problem areas, map them, plan their upgrading and maintenance needs and budget for the necessary improvements. Once constructed or upgraded, incorporate their maintenance into the community-wide schedule of stormwater drainage work.

Establish a regular maintenance work element for road and street drainage facilities.

- Regular maintenance of drainage ditches, catch basins, culverts, the underside of bridges, roadside bankings, shoulders and nearby streams to remove debris and assure channel flow is essential for efficient stormwater removal.

- Regular street sweeping can reduce sediments in the drainage system and can reduce pollutants from entering surface and ground water resources. Fall leaf waste clogs drainage ditches and structures and adds phosphorus to streams and wetlands causing unwanted aquatic growth. Proper leaf disposal methods include:
 - Sweep leaves off curbs, sidewalks, driveways and storm sewer openings.
 - Compost leaves and organic debris if possible before bagging and dump disposal.
 - If bagged leaves are to be collected by the municipality, place the leaves on lawns near street curbs rather than in the drainage gutters or on sidewalks.
- Make notes of problems and the corrective measures that are needed. Consider heavy rains and snowmelt conditions when assessing the drainage systems within the roadway watershed.
- The maintenance of detention and retention ponds is necessary to assure their proper function. Pond maintenance can be included in the task list for community roads and streets.

Managing water on the road surface, in the roadbed and on the sides of the road is central to good road maintenance

4. Inventory non-point pollution sources that are aggravated by stormwater runoff. Locate these areas on the community map and address the means for reducing pollutant release. For a listing of possible solutions, refer to the publication “Nonpoint Source Pollution: A Guide for Citizens and Town Officials” available from the NHDES information office in Concord. As pollution sources are identified, consider the level of salt application during the winter months. An excessive pavement salt application amount can injure vegetation and degrade the groundwater reserves.
5. Review the Community Emergency Management Plan to understand the potential and impacts of flooding and drainage associated events. Also, it is important to know emergency routes when equipment or traffic flow access is needed for disaster response. These routes should receive maintenance priority; the road surfaces and associated drainage facilities should be in optimum condition.
6. Organize the municipal facility maintenance tasks using the mapped trouble spots as a guide for priorities and scheduling crews. On a regular basis, drive and observe all roads with road condition and storm water drainage needs as the primary focus. Record the findings and build the upgrading tasks into work schedules and budgets.
7. As an element of the facility stormwater management program, include training and education in runoff and erosion issues for all road management staff. Consider the assistance that can be provided by the New Hampshire Department of Environmental Services and the UNH Technology Transfer Center.
8. Make stormwater management a standard work task with a year round schedule of duties. Maintenance and upgrading of stormwater facilities is an item that requires yearly planning,

priorities and cost projections for community funding. Staff, equipment, repair and upgrading materials are all budget items associated with effective stormwater management.

Establish a rigorous surveillance program to detect illicit discharges in the community stormwater system

With the assistance of the New Hampshire Department of Environmental Services, organize and implement an inspection and monitoring program for water quality in stormwater drainage. On a regular basis drainage water samples can be analyzed for pollutants. By recording and mapping the analysis findings, patterns and networks of stormwater drainage can be identified for maintenance or reconstruction to eliminate pollutants from stormwater outflows.

The implementation of a surveillance program is a requirement for selected stormwater systems under the Phase II National Pollutant Discharge Elimination System. The NHDES encourages all communities to inspect and monitor their stormwater systems to identify pollution problems and to improve water quality.

Based on the findings of the surveillance program, develop a strategy for eliminating illicit discharges in the community. Require inspections for new construction and establish a long term schedule for reconstructing connections that dump sewage into the stormwater drainage system.

Conduct a program of drainage system stenciling

Implement a program for storm-drain stenciling to discourage people from dumping trash into storm sewer systems. Stenciling drain inlets and catchbasins can be done by an organized group of local volunteers. A long-term storm drainage education program that involves the whole community should support the stenciling project.

Suggested steps for a successful stenciling program include:

1. Distribution of information; create a brochure describing the problem and solutions that can be undertaken by property owners.
2. In preparation for the stenciling project, make sure permission is granted by all public and private property owners.
3. Training for the volunteers for proper stenciling technique and safety as the stencils are applied.
 - Obtain all materials and prepare the stencils. Conduct a training and orientation workshop for volunteers.
 - Passing traffic must be considered when the volunteer groups are stenciling roadway drains. The Police Department should be notified when stenciling is scheduled for the public rights-of-way.
 - Work in groups, with each individual having an assignment related to safety, public interaction and the stenciling activity.

4. Publicize the stenciling project and make the day of stenciling a special event in the community.
5. Stencil in good weather, not too wet or cold.
6. Involve the media and plan follow-up activities to encourage respect for water quality and water related natural habitat.

Encourage Coastal Zone community initiatives

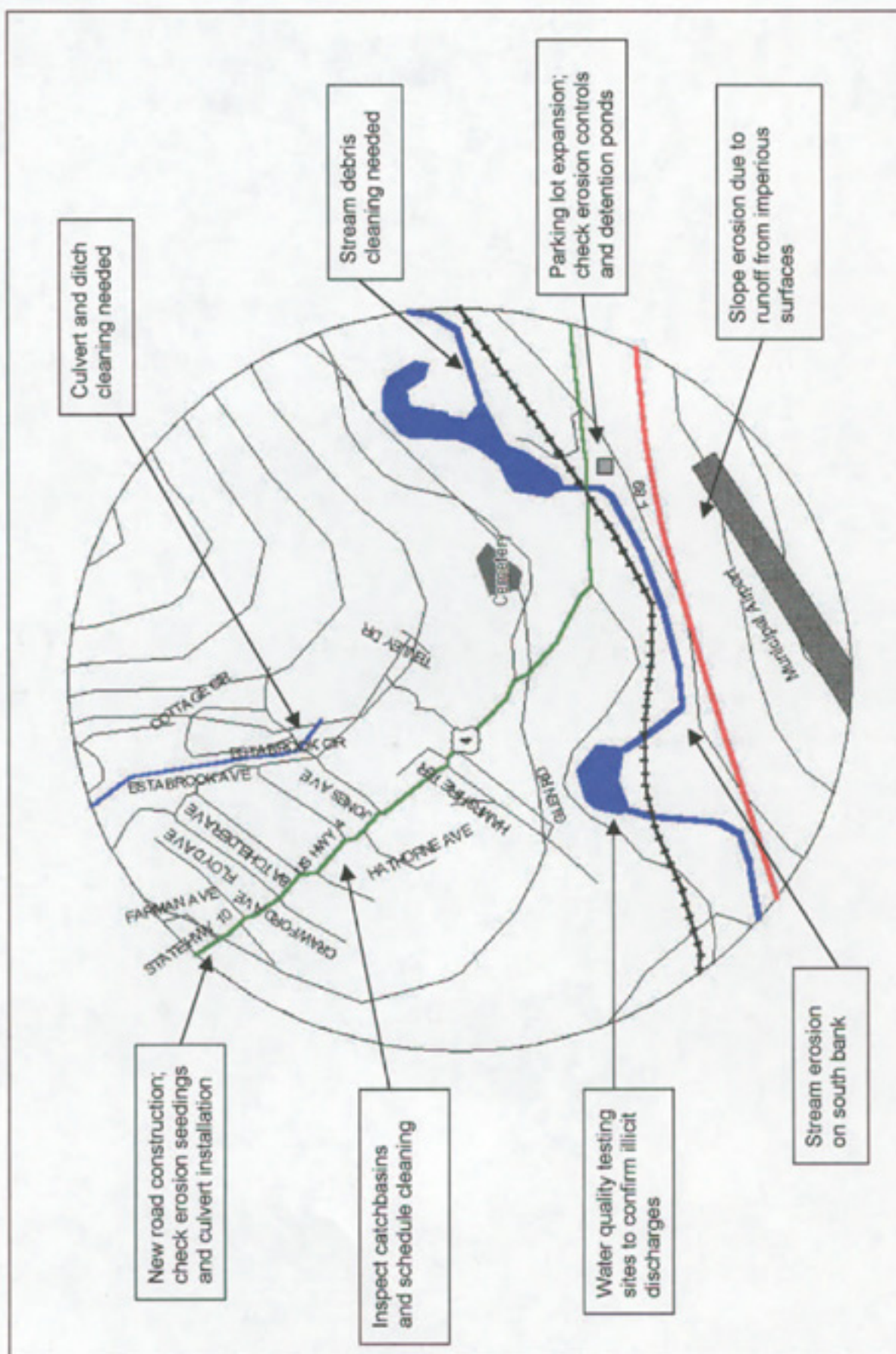
From the standpoint of stormwater management, the New Hampshire coastal zone encompasses those communities that are located in the watersheds flowing to the Atlantic Ocean. The Piscataqua and Great Bay watersheds are critical water resources in the New Hampshire coastal zone. All of the activities mentioned in this chapter are appropriate for implementation. Yet this watershed area is unique. Clearly, those living in the coastal watershed depend on one another for maintenance of a quality living environment. The New Hampshire seacoast is the focus for ocean and seaport related business and recreation. It is an area experiencing dramatic growth. Many feel that these characteristics make the coastal region a highly desirable place to live, recreate and work. The message that everyone makes a difference, in other words, everyone's activity affects the air and water and land that all share is easily explained and can become the focus for environmental protection initiatives.

An education program delivering the stormwater pollution story for this unique watershed is a special project for all coastal communities. The strongly linked relationship between land use decisions and quality of life in the seacoast area provides the potential for a highly effective program series addressing environmental protection with an emphasis on stormwater management.

The New Hampshire Coastal Program Office, 152 Court Street in Portsmouth, New Hampshire (603-431-9366), can provide communities and seacoast protection groups with many guidelines and resources for addressing local environmental issues. The staff can assist communities with outreach meetings or technical information to help guide positive stormwater management activities.

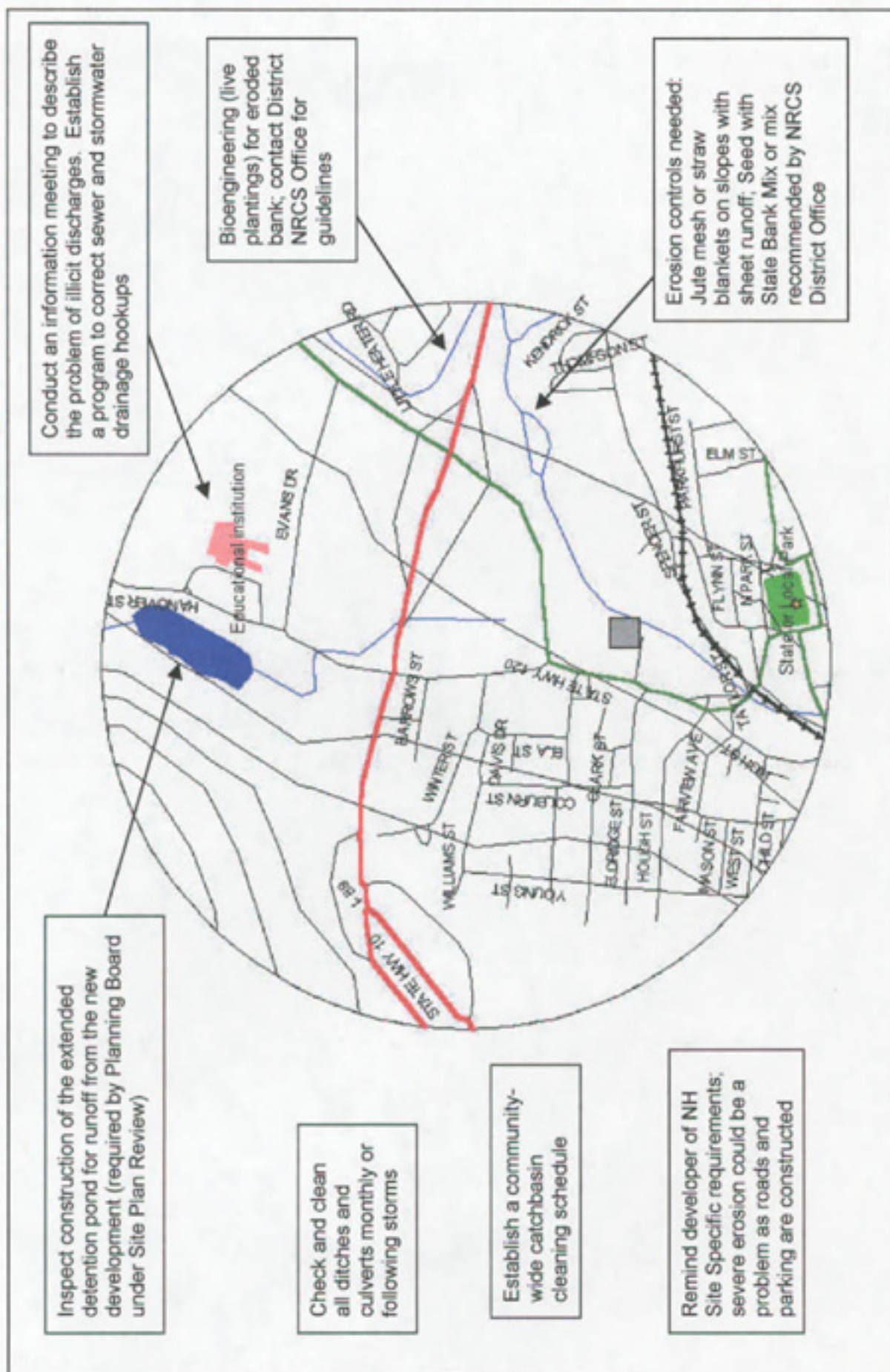
Utilize Community Maps Showing Stormwater Runoff Problems and Priority Actions

A community base map can be an effective tool in identifying stormwater problems in a community. Have professionals and/or trained volunteers utilize these maps for field notes describing stormwater issues and problems. Back in the office, recommended stormwater control actions can be placed on a second map. These maps represent a convenient reference for public and administrative meetings, budget planning and work crew scheduling.



COMMUNITY MAP

STORMWATER RUNOFF PROBLEMS



CHAPTER IV

Support Resources for Managing Stormwater

AGENCIES:

New Hampshire Department of Environmental Services (NHDES):

NHDES Water Division, stormwater management assistance: 64 North Main Street,
Concord, NH 03302-2008; 603-271-2358.

Publications:

- “Best Management Practices for Urban Stormwater Runoff,” NHDES Water Supply and Pollution Control Division; January 1996.
- “Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire,” NHDES, Rockingham Conservation District, USDA Soil Conservation Service; August 1992.
- “Stormwater Characterization Study” NHDES; November 1997.
- “Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials,” May 1994, Rev. November, 1997.
- Fact Sheet WD-SWQB-3: “Federal Stormwater Permits.”
- Fact Sheet WD-BB-30: “Erosion Control for Construction in the Protected Shoreland Buffer Zone.”

NH Coastal Program; New Hampshire Estuaries Project:

Office: 152 Court Street, Portsmouth, NH 03801; 603-433-7187.

- Fact Sheet: “Stormwater Runoff: Nonpoint Source Pollution of the Great Bay Estuary.”

Environmental Protection Agency Office of Water:

Region 1 District Office (Boston, MA.) NPDES Phase II assistance: 617-918-1615.

Publications:

"Operation, Maintenance and Management of Stormwater Management Systems" by the Watershed Management Institute, Inc. This manual presents a comprehensive review of the technical, educational, and institutional elements needed to assure that stormwater management systems are designed, built, maintained and operated properly during and after their construction.

It was developed in cooperation with the U.S. EPA Office of Water to assist individuals responsible for designing, building, maintaining, or operating stormwater management systems. It will also be helpful to individuals responsible for implementing urban stormwater management programs. The cost of the manual, including the forms supplement, is \$27.00, which includes first class shipping. To order, send a check, money order, or purchase order to Watershed Management Institute, Inc., 410 White Oak Drive, Crawfordville, Florida 32327. For more information contact Eric Livingston at (850) 926-5310, fax (850) 926-1534.

FEID Number: 59-3140267

Watershed Management Institute, Inc.

410 White Oak Drive

Crawfordville, Florida 32327

- Fact Sheet: “The NPDES Storm Water Program – The Phase II Proposed Rule,” EPA Office of Wastewater Management; May, 1999.
- “Economic Benefits of Runoff Controls,” EPA Office of Wetlands, Oceans and Watersheds publication # EPA 841-S-95-002; September 1995.
- Fact Sheet: “Managing Urban Runoff,” EPA Office of Water “Nonpoint Pointers,” publication # EPA-841-F-96-004G, March 1996.
- Note: as of this writing many more stormwater/NPDES fact sheets are under construction by the EPA Office of Water; they can be accessed through the EPA Web site listed below.

UNH Technology Transfer Center publications:

Office: University of New Hampshire, 33 College Road, Kingsbury Hall, Room 231,
Durham, NH 03824-3591; 603-862-2826.

Publications:

- “Drainage, Drainage, Drainage The Importance of Drainage on Local Roads,” Technology Transfer Center, UNH; January 1996.
- “A Series of Quick Guides for New Hampshire Towns, Assisting Local Road Maintenance & Construction Through Cooperation,” The North Country Resource Conservation and Development Area, Technology Transfer Center; 1992 - 1993.

Other publications:

- Ferguson, Bruce L.; “Introduction to Stormwater; Concept, Purpose, Design”; John Wiley and Sons; January, 1998.
- “Erosion Control” Magazine; Forester Communications, Inc., Santa Barbara, CA. Published nine times per year; the Official Journal of the International Erosion Control Association.

Internet Web Sites Providing Stormwater Management Information:

http://www.state.nh.us	The NH State Web page “Webster”
http://www.state.nh.us/des/discover/htm	The NH Department of Environmental Services
http://www.state.nh.us/coastal	The NH Coastal Program
http://pubpages.unh.edu/~kldr/tech.html	The UNH Technology Transfer Center (publications)
http://www.t2.unh.edu/	The UNH Technology Transfer Center
http://199.92.250.14/Lawsof.NH/index.htm	NH Revised Statutes Annotated
http://nhresnet.sr.unh.edu	New Hampshire Resource Net
http://www.nrcs.usda.gov/NRCSProg.html	The USDA NRCS listing of offered programs
http://wave.nos.noaa.gov/OCRM/czm	The NOAA Office of Coastal Zone Management
http://iwin.nws.noaa.gov/iwin/nh/State.html	New Hampshire State weather forecasts
http://www.epa.gov/OWOW/NPS	EPA Office of Wetlands, Oceans and Watersheds
http://www.epa.gov/owm/stormw.htm	EPA NPDES Stormwater Program & links
http://www.epa.gov/ost/stormwater/	EPA Urban Stormwater BMP Study & links
http://www.epa.gov/owm/swlib.htm	EPA Stormwater Library
http://www.usace.army.mil	US Army Corps of Engineers
http://www.4government.com	Links to all Federal Agencies
http://www.fema.gov	Federal Emergency Management Agency
http://www.ieca.org	International Erosion Control Association
http://www.erosioncontrol.net	Erosion Control Magazine

CONSULTANTS:

New Hampshire Chapter of the National Society of Professional Engineers
c/o David Gates, President (current)
CLD Consulting Engineers
540 Commercial Street
Manchester, New Hampshire 03101
Web site: www.unh.edu/nhspe

Note: The New Hampshire Department of Transportation (Divisions of Project Development and Public Works and Transportation) maintains a listing of prequalified consultants, including engineering firms. Communities may choose to review this roster for assistance with their selection of engineering consultants.

Granite State Landscape Architects
POB 305
Concord, NH 03302-0305

NH Association of Wetland Scientists
POB 4443
Manchester, NH 03108-4443

NH Council of Certified Soil Scientists
POB 110
Concord, NH 03302